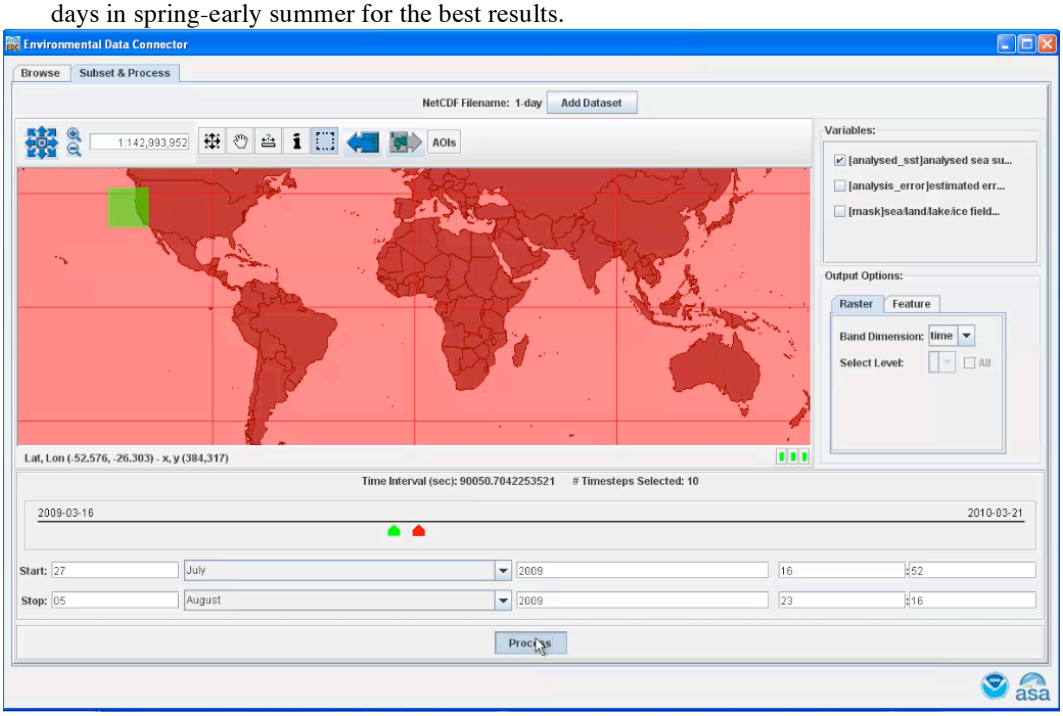
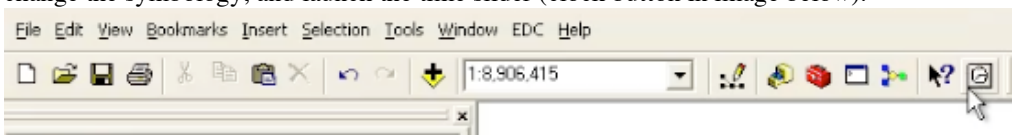
EDC Salmon & Albatross Handout

1. Download the file EDC-salmon.zip (~130 MB) and save it to **C:\arcgis\CCS** directory.
2. Extract the file above to the directory **C:\arcgis\CCS\EDC-salmon**. If you have WinZip, you can accomplish this from Windows Explorer or My Computer by navigating to the **C:** directory, right clicking on the **EDC-salmon.zip** file, selecting **WinZip** and then **Extract to here**. If you don't have WinZip, just open the file with Windows and follow the instructions. You might have to change some options to get it to extract to **C:\arcgis\CCS\EDC-salmon**.
3. Open **EDCsalmon.mxd** in ArcGIS 9.3 and click on the EDC menu and then select the Environmental Data Connector.
4. Hit **Connect** to ERD's THREDDS Server (default Catalog URL) to see available datasets hosted at ERD.
5. Navigate to Satellite Datasets, Temperature, SST, GHRSST Blended, Global and choose 1-day. Click on **Subset & Process** button.
6. Choose an area off the coast of California that is not too large to crash the servers, and choose 10 days in spring-early summer for the best results.

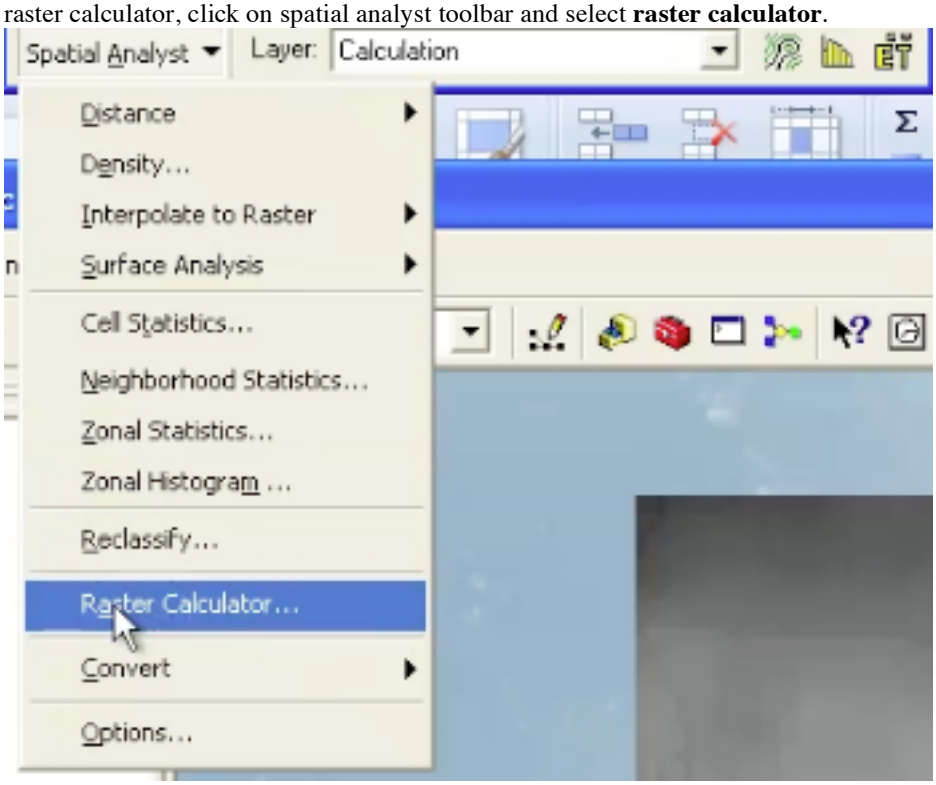


7. Name the output file **GHRSSTc**.
8. After the file is downloaded, subset, and converted to a raster file, you should see an Arc layer GHRSSTc which is a multi-band raster image. Essentially, each time step as been included as a raster band allowing the time slider to display each image. Turn off extraneous layers if desired, change the symbology, and launch the time slider (clock button in image below).

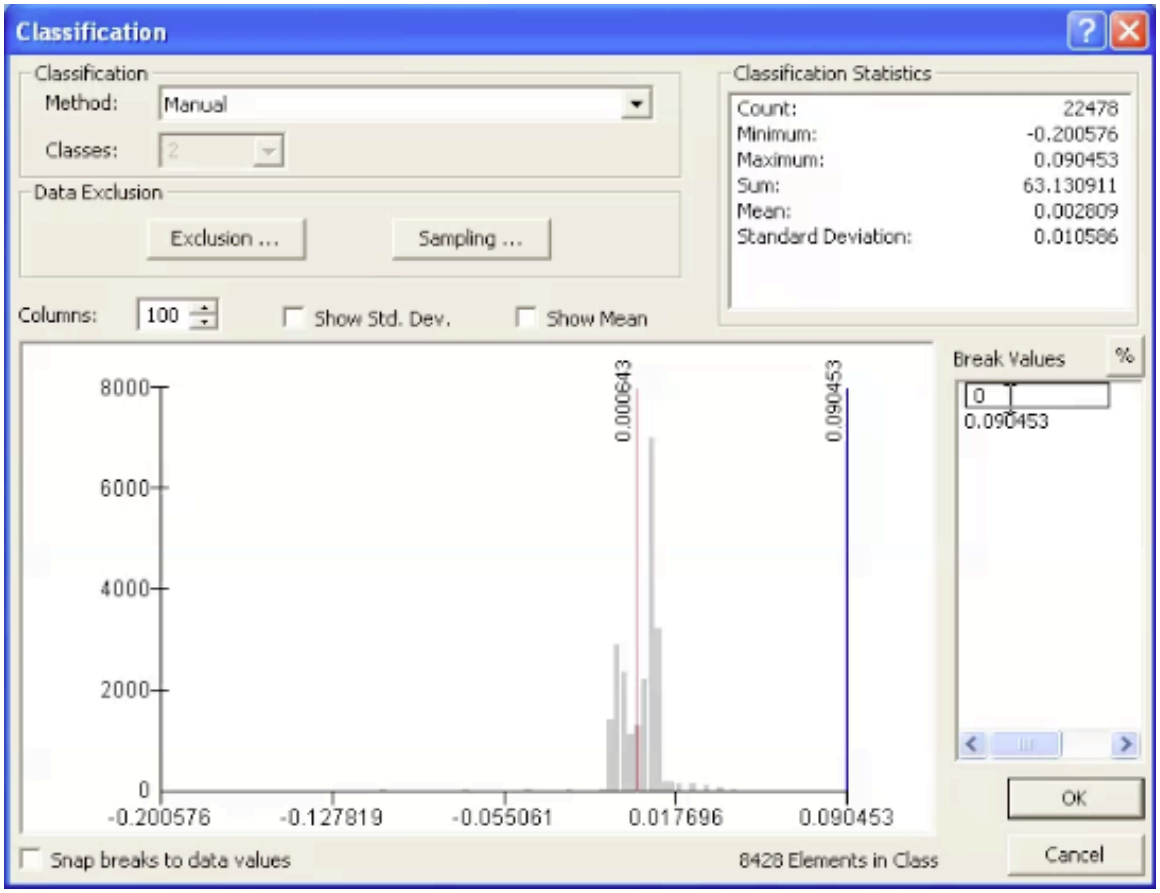


9. Hit play on the timeslider to see the time periods of SST sequentially.
10. When you are done visualizing the data, it is important to **bring in the raw raster files** for analysis purposes as you cannot perform analyses on the multi-band raster image that is automatically loaded.
11. Click on the plus symbol to add data, and navigate to **C:\EDC\GHRSSTc**, and add all files ending with c1-c10 (or higher if you choose more than 10 timesteps) using shift-click. We will only look at one file as part of this example.

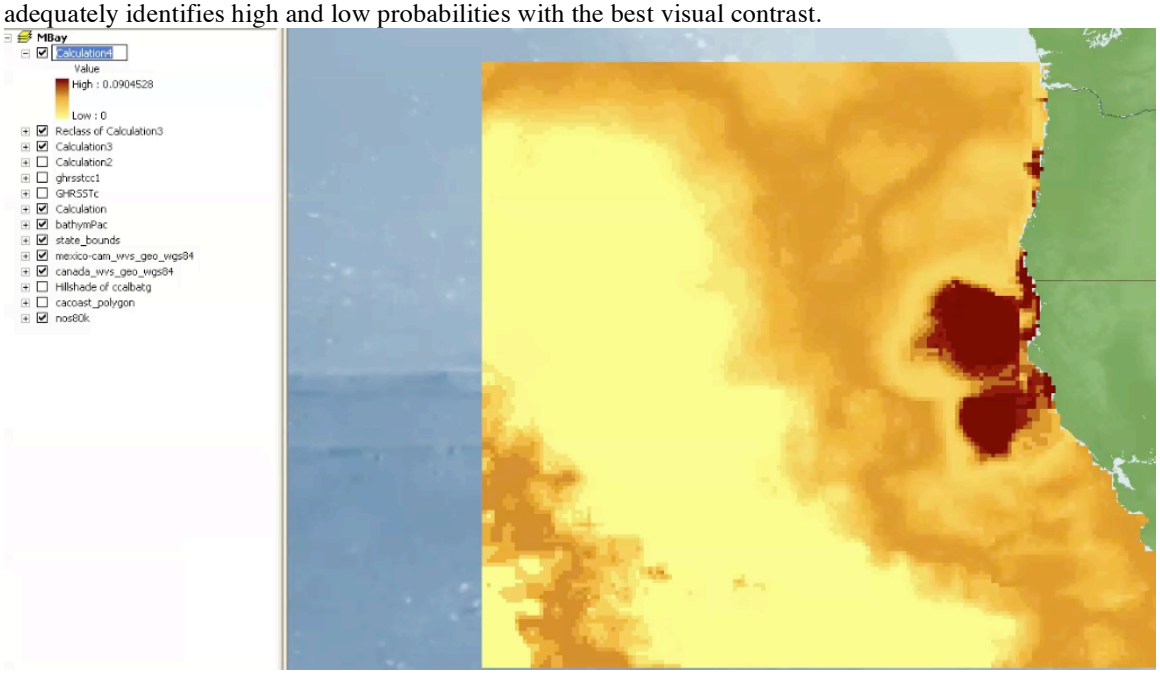
12. I have included an excel file that has the two equations that you will need to convert temperature into king salmon probability, so open **C:\arcgis\CCS\EDC-salmon\chinook_all.csv.**
13. Copy `[ghrsstcc1]-273.15` and return to ArcGIS to launch the raster calculator. To launch the raster calculator, click on spatial analyst toolbar and select **raster calculator**.



14. Paste the copied formula into the box and change as needed if you added a different time step (c1 becomes c5 for example). This equation converts from Kelvin to Celsius.
15. Launch Raster calculator a second time and enter the second formula in the csv file worksheet, `Pow([Calculation2], 7) * -0.000001093852212 + Pow([Calculation2], 6) * 0.000109423351012 + Pow([Calculation2], 5) * -0.00457407017759 + Pow([Calculation2], 4) * 0.103181534534469 + Pow([Calculation2], 3) * -1.35022135951488 + Pow([Calculation2], 2) * 10.192548337881 + Pow([Calculation2], 1) * -40.8545392105836 + 66.8615288886849` into the raster calculator. This is the 7th order polynomial fit to salmon tag data (see Hinke et al. 2005).
16. The resultant surface, Calculation 3 if you haven't renamed anything along the way is the probability surface for king salmon based on SST. However, some values are negative (and in this case we can't have a negative probability) simply due to overfitting. We will use the reclassify tool to fix this.
17. Click on Spatial Analyst again and choose **Reclassify** (one up from Raster Calculator) and select Calculation3 as the surface. Switch the Classes to 2, and the Classification Method to manual. Rename the first break value to 0 and hit ok



18. Change the resulting new values in the Reclassify screen to **0 for all Old values < 0** and to **1 for all old values > 0** and click ok. This will create a transformation surface we can multiply with our previously calculated surface.
19. Launch Raster Calculator one last time and multiply Calculation3 by Reclass of Calculation3 to obtain a corrected probability surface. You can then change the symbology to something that adequately identifies high and low probabilities with the best visual contrast.



EDC Albatross

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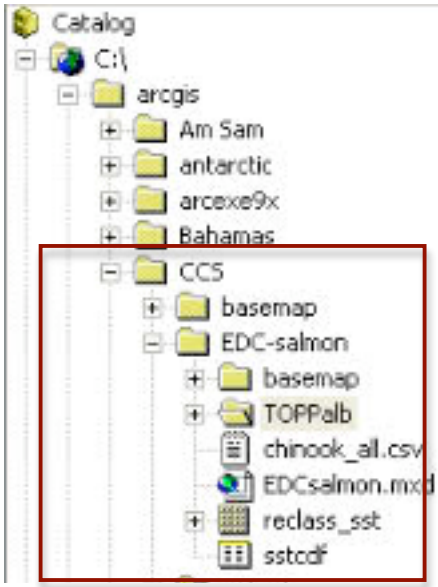
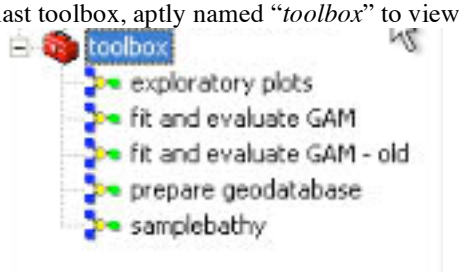
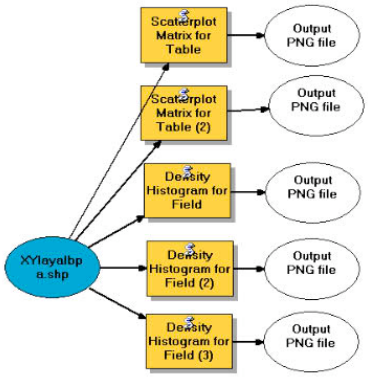
3. 

4. The ZIP file includes the satellite oceanography data files and species observations. If you want to re-download the data, you can download these yourself from OBIS-SEAMAP. Go to http://seamap.env.duke.edu/datasets/detail/477, click on the **Download** tab, and download the data as an ESRI shapefile. You will have to accept the OBIS-SEAMAP Terms of Use. Save the file to **C:\arcgis\CCS\EDC-salmon\TOPPalb\seamap477.zip**.
5. Unzip **C:\arcgis\CCS\EDC-salmon\TOPPalb\seamap477.zip** into the directory that contains it.
6. We have already downloaded the data for you, run Xtracto to sample oceanographic parameters temperature and chl-a (see Dave's example) and bathymetry (model #5) based on spatial and temporal location, and created a geodatabase for Arc including all Albatross tracks entitled **PointsToSample** (model #4). You are now ready to run the exploratory statistical models (models #1&2). In ArcCatalog, open the last toolbox, aptly named "*toolbox*" to view the available models.

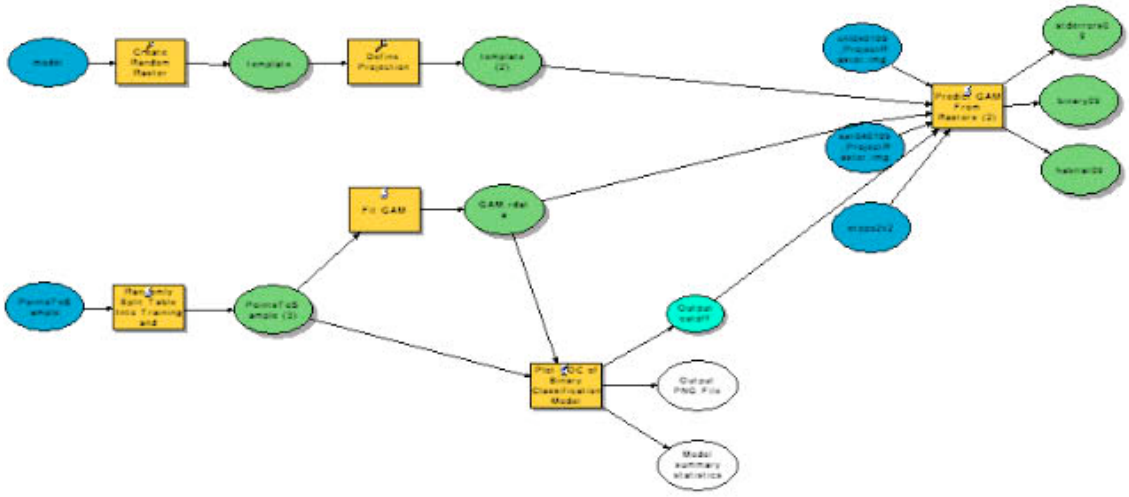
a. 

7. Right-click on the first one ***exploratory plots*** and select **Edit**. The model should look like the image below. Open the **Model** menu at the top and select **Delete Intermediary Data**. Once this is done, **Run entire model**. We have supplied the model in a completely run format so if Arc crashes when running each step, you can always get intermediary or final products from the original zip file.



8.

9. After the first model completes, run the second model ***fit and evaluate GAM*** using the same method. Right-click, select **Edit**, open the **Model** menu and select **Delete Intermediary Data** and then **Run entire model**. You have to close each plot (save if interested first) before the model completes. For help describing or parameterizing a GAM, one of the best resources is the R help file mirrored here: http://stat.ethz.ch/R-manual/R-devel/library/mgcv/html/gam.html



Important notes ¶

- On ArcGIS 9.3, the **Step 2: Create absence points** model may initially show a red X, suggesting that it won't work. It will. The red X occurs because the model was built with ArcGIS 9.2, and 9.3 thinks there is a problem with the model. There isn't. Just run it like the others.
- If you unzipped the example to some other directory than **C:\HabModExample2**, the **Step 3: Sample oceanography rasters at points** model will fail when it reaches the **Sample Rasters Listed in Fields** tool. The problem is that this model assumes the example is stored in **C:\HabModExample2** and the sampling fails when it cannot find the directory. To fix this, you must change the model to use your directory:
    - In the toolbox, right click on **Step 3: Sample oceanography rasters at points** and select **Edit**.
    - Double-click the first **Calculate Field** tool.
    - In the **Expression** parameter, change the path in the first component of the expression from **C:\arcgis\CCS\EDC-salmon**to your directory. Note: if you do use your own directory, we highly recommend it not contain any spaces.
    - Repeat the procedure above for the other two **Calculate Field** tools.
    - Now you can run the model.
- If you have R 2.9.x and you experience a failure from the **Predict GAM From Rasters** tool in the **Step 5: Fit and Evaluate a GAM, and predict habitat** model that says **GDAL Error 3: Attempt to read past EOF**, please see ticket #375 for a discussion of and solution to this problem.
- For more examples, check out the MGET website (including a video of a similar habitat model on the east coast of the US - http://code.env.duke.edu/projects/mget/wiki/HabitatModeling